



2015 Minerals Yearbook

ZINC [ADVANCE RELEASE]

ZINC

By Amy C. Tolcin

Domestic survey data and tables were prepared by Hodan A. Fatah, statistical assistant, and the world production tables were prepared by Glenn J. Wallace, international data coordinator.

In 2015, U.S. mine production of recoverable zinc was 797,000 metric tons (t), essentially unchanged from that of 2014 (table 1). The value of domestic mine production of recoverable zinc was approximately \$1.68 billion. Alaska continued to be the dominant zinc-producing State, followed by, in descending order of quantity, Tennessee, Washington, Missouri, and Idaho. On a contained-zinc basis, the United States exported 86% of its zinc mine production (709,000 t of zinc in concentrate) to foreign smelters for processing. Leading destinations for domestic exports of zinc contained in concentrates were Canada (32%), the Republic of Korea (17%), and Spain (12%) (table 6). Regionally, 35% of exports were sent to Asia and the Pacific, 33% to Europe, 32% to North America, and less than 1% to Central America and South America. Imports for consumption of zinc contained in concentrates were significantly less than exports as the only domestic primary zinc smelter mostly consumed domestically produced zinc concentrates (table 1). Total U.S. refined zinc production in 2015 decreased by 4% to 172,000 t owing to a decrease in secondary production (table 1). Imports for consumption of refined zinc in 2015 decreased by 4% to 771,000 t (table 1) and were sourced primarily from Canada (62%), Mexico (13%), and Australia (11%). Domestic exports of refined zinc decreased by 7,100 t to 12,700 t in 2015 (table 1). Apparent consumption of refined zinc decreased by 4% from that of the prior year to 931,000 t (table 1). Most reported refined zinc consumption was for galvanizing, and other major end uses were brass and bronze and zinc-base alloys (table 5). Global zinc mine production decreased by 4% to 12.8 million metric tons (Mt), and zinc metal production increased slightly to 13.9 Mt (tables 9, 10). According to data from the International Lead and Zinc Study Group (ILZSG), global zinc metal consumption remained unchanged in 2015 at 13.7 Mt, about 152,000 t below ILZSG's tabulated metal production of 13.9 Mt (International Lead and Zinc Study Group, 2016c, p. 44, 47).

Legislation and Government Programs

A U.S. Government stockpile of refined zinc has been maintained since 1967 for national defense purposes. Public Law 102-484, signed in 1992, authorized the disposal of the entire inventory of zinc from the National Defense Stockpile (NDS). Sales of zinc from the NDS, however, were suspended in August 2008 owing to concerns regarding domestic availability and access to various raw materials. The Defense Logistics Agency Strategic Materials relisted zinc on the Annual Materials Plan (AMP) for fiscal year 2016 (October 1, 2015, through September 30, 2016). The AMP ceiling quantity for zinc was 7,250 t, which represented the maximum quantity of zinc that could be sold from the NDS during the fiscal year. At

yearend 2015, the reported inventory of zinc remained at 7,250 t (Defense Logistics Agency Strategic Materials, 2015).

In February, the Office of the U.S. Trade Representative asked the World Trade Organization to organize a panel to consider its contention that China allegedly subsidized its domestic businesses in several markets, including galvanized steel, by providing free and discounted services and cash grants to enterprises if they meet export performance criteria (Metal Bulletin, 2015a; Office of the U.S. Trade Representative, 2015).

In June, six steel producers with operations in the United States (AK Steel Corp., ArcelorMittal USA LLC, California Steel Industries Inc., Nucor Corp., Steel Dynamics Inc., and U.S. Steel Corp.) filed antidumping and countervailing duty petitions with the U.S. Department of Commerce (DOC) and the U.S. International Trade Commission asserting that unfairly traded imports of corrosion-resistant steel, including galvanized steel, from producers in certain countries benefitted significantly from government-sponsored subsidy programs that allowed those producers to price products at less than fair value (Fitzgerald and Tran, 2015). In November, in response to the petitions, the DOC announced that it had preliminarily determined that countervailable subsidies were provided to producers and exporters of corrosion-resistant steel products (including galvanized steel) in China, India, Italy, and the Republic of Korea, and the DOC instructed the U.S. Customs and Border Protection to collect cash deposits based on its preliminary subsidy rate determinations. The preliminary subsidy rates ranged from 26.26% to 235.66% for China, from 2.85% to 7.71% for India, from 13.06% to 38.41% for Italy, and 1.37% for the Republic of Korea. The DOC was scheduled to announce its final determination in January 2016 (U.S. Department of Commerce, International Trade Administration, 2015).

Production

Mine.—In 2015, zinc was produced in five States; Alaska was the leading zinc-producing State, followed by Tennessee, Washington, Missouri, and Idaho (table 3). Domestic mine production of recoverable zinc in 2015 was 797,000 t, essentially unchanged from that of 2014 (table 1).

Alaska.—Teck Alaska Inc. (a subsidiary of Teck Resources Ltd., Canada) operated the open pit Red Dog zinc-lead mine in the Northern Region, the leading zinc-producing mine in the United States (table 3). The Red Dog property consists of several sedimentary-exhalative lead-zinc sulfide ore bodies and was leased and operated under an agreement with NANA Regional Corp. Inc. (Kotzebue, AK), an Alaska Native-owned corporation. Teck reported that zinc in concentrate production at Red Dog decreased by 5% to 567,000 t in 2015 from 596,000 t in 2014 owing to decreased mill throughput as a result of an extended

maintenance shutdown at the mill. Approximately 30% of the zinc concentrates produced at Red Dog were refined at Teck's metallurgical complex at Trail, British Columbia, Canada. The remaining concentrates were exported to Asia and Europe. Most of Red Dog's concentrates were sold through long-term contracts, with the balance sold on the spot market. Reported reserves at yearend 2015 contained 8.26 Mt of zinc, and mine life was expected to extend to 2031. Teck projected that zinc production at Red Dog would decrease in the next few years, ranging between 545,000 and 570,000 t in 2016 and between 500,000 and 550,000 metric tons per year (t/yr) from 2017 through 2019 (Teck Resources Ltd., 2016a, p. 35–37; 2016b, p. 20).

Hecla Mining Co.'s (Coeur d'Alene, ID) underground Greens Creek Mine recovered metals from a polymetallic (gold-lead-silver-zinc) massive sulfide deposit on Admiralty Island in the Tongass National Forest near Juneau. The mine produced bulk zinc-lead, lead, and zinc concentrates and a gravity concentrate that was upgraded into gold and silver dore by a third party processor. Hecla reported that zinc in concentrate production rose by 4% from that of 2014 to 56,200 t owing to an increase in the average zinc ore grade. Reported yearend 2015 reserves at Greens Creek contained 530,000 t of zinc, and mine life was expected to extend to 2025 (Hecla Mining Co., 2016, p. 28–31, 56–57).

Idaho.—Hecla operated the Lucky Friday Mine, an underground silver-lead-zinc mine in the Coeur d'Alene mining district in northern Idaho, which produced silver-lead concentrate and zinc concentrate. In 2015, reported zinc production was 7,380 t, essentially unchanged from that of 2014. All concentrates were sent to Teck's metallurgical facility in Trail for processing. Reported reserves at yearend 2015 contained 142,000 t of zinc, and mine life was expected to extend for 21 years (Hecla Mining Co., 2016, p. 33–37).

Missouri.—Doe Run Resources Corp. (St. Louis, MO) operated a series of production shafts in the Mississippi Valley-type (MVT) lead-zinc-copper ore bodies of the Viburnum Trend in southeast Missouri. In 2015, Doe Run processed ore from the Brushy Creek, Buick, Fletcher, Sweetwater, and Viburnum (#29 and #35) Mines at four mills to produce primarily lead concentrates and, to a lesser extent, zinc and copper concentrates.

New York.—Star Mountain Resources, Inc. (Tempe, AZ) announced in October that it had entered into a definitive agreement with HudBay Minerals Inc. (Canada) and Northern Zinc LLC (Carson City, NV) to purchase their interests in Balmat Holding Corp., including the operating subsidiary, St. Lawrence Zinc Company LLC, and its mining operations in the Balmat mining district in St. Lawrence County. HudBay Minerals owned Balmat, and Northern Zinc held an exclusive purchase option with HudBay to acquire Balmat. HudBay placed the Balmat zinc mine on care-and-maintenance status in August 2008 owing to low zinc prices. Balmat's previous capacity was 60,000 t/yr of zinc in concentrate (Lavigne, 2015; Star Mountain Resources, Inc., 2015).

Tennessee.—Nyrstar NV (Belgium) owned and operated the East Tennessee and Middle Tennessee zinc mine complexes that recovered ore from MVT zinc deposits. The two mine complexes produced zinc concentrates, of which the Middle Tennessee concentrates contained a recoverable amount of

gallium and germanium. Zinc in concentrate production at the two complexes was essentially unchanged from that of 2014 at 112,000 t. Zinc production at the East Tennessee mine complex (Coy Mine, Immel Mine, and Young Mine and mill) was 64,400 t, and production at the Middle Tennessee mine complex (Cumberland Mine, Elmwood Mine, and Gordonsville Mine and mill) was 47,200 t. Concentrates were sent to Nyrstar's Clarksville, TN, zinc refinery for processing. In December, Nyrstar placed the Middle Tennessee mines on care-and-maintenance status to reduce costs in its mining segment as zinc prices in the fourth quarter fell below the operating costs of the mines. Reported reserves of zinc at yearend 2015 were 101,000 t at East Tennessee and 62,000 t at Middle Tennessee (Nyrstar NV, 2016a, p. 18, 23; 2016b).

Washington.—In December 2014, Teck reopened the underground Pend Oreille Mine and began shipping lead and zinc concentrates to its nearby metallurgical facility in Trail for processing. Pend Oreille is a carbonate-hosted zinc-lead ore body near Metaline Falls in northeast Washington State. The mine opened in 2004 and was placed on care-and-maintenance status in February 2009 owing to low zinc prices at the time (Teck Resources Ltd., 2014). Zinc in concentrate production at Pend Oreille was 31,000 t in 2015, and Teck projected that zinc production would increase to 40,000 t in 2016. The mill reached 90% of its ore throughput capacity of 2,000 metric tons per day (t/d) in December 2015. Reported reserves at yearend 2015 contained 199,000 t of zinc, and mine life was expected to extend 4.5 years (Teck Resources Ltd., 2016a, p. 38–39, 45; 2016b, p. 19–20).

Smelter.—In 2015, refined zinc was mainly produced in two States: North Carolina (Horsehead Holding Corp.'s Mooresboro facility) and Tennessee (Nyrstar's Clarksville zinc refinery). A smaller quantity of zinc metal was produced by U.S. Zinc Corp.'s (owned by Votorantim Metais, Brazil) zinc recycling operation in Houston, TX. Refined zinc production in 2015 decreased by 4% from that of 2014 to 172,000 t owing to a decline in secondary production (table 1).

Nyrstar's Clarksville electrolytic zinc refinery was the only primary zinc smelter in the United States. Clarksville mostly treated zinc concentrate from Nyrstar's East Tennessee and Middle Tennessee zinc mine complexes, but also treated imported zinc concentrates and domestically sourced secondary crude zinc oxide. Refined zinc production at Clarksville in 2015 increased by 13% from that of 2014 to 124,000 t owing to roaster shutdowns in 2014 that reduced production. Clarksville produced Special High Grade (SHG) and Continuous Galvanizing Grade (CGG) zinc. Byproducts included cadmium metal, copper cementate, copper sulfate, germanium leach product, synthetic gypsum, and sulfuric acid. In 2016, zinc production at Clarksville was expected to decrease by at least 9,000 t as purchased zinc concentrates sourced from external sources would only partially offset the loss of supply from the Middle Tennessee mines (Nyrstar NV, 2015b; 2016a, p. 9–10, 18).

Horsehead's solvent extraction–electrowinning (SX–EW) zinc refinery in Mooresboro, NC, began operating in May 2014. The plant produced SHG and CGG zinc in addition to Prime Western-grade (PW) zinc from secondary materials, sourced mostly from the company's four electric arc furnace (EAF) dust recycling

operations in Barnwell, SC; Calumet, IL; Palmerton, PA; and Rockwood, TN. EAF dust is a waste product recovered from the air flow exiting EAFs during the steel recycling process and typically contains 10% to 20% zinc. Horsehead's EAF dust recycling operations produced crude zinc oxide that contained about 60% zinc. In 2015, Mooresboro produced about 34,500 t of zinc. The company reported that ongoing operational issues at Mooresboro delayed the facility's rampup to full production capacity of 140,000 t/yr. As Mooresboro continued to ramp up in 2015, excess crude zinc oxide was further refined into zinc calcine (65% to 70% zinc) at the Palmerton facility (Horsehead Holding Corp., 2015, p. 35, 38).

U.S. Zinc produced PW zinc and zinc dust at its zinc recycling facility in Houston, TX. Feed materials were mainly top dross from continuous galvanizers and bottom dross and skimmings from general galvanizers. U.S. Zinc also produced zinc oxide at two recycling facilities in Tennessee (U.S. Zinc Corp., 2016).

ZincOx Resources plc (United Kingdom) sold the Big River Zinc smelter site in Saugeit, IL, to be redeveloped into a fabrication and distribution facility for aluminum and steel products. The Big River Zinc smelter had been placed on care-and-maintenance status in 2005 prior to its sale in May 2006 to ZincOx, which planned to convert the smelter into a secondary operation to treat crude zinc oxide in a leach and SX-EW circuit to produce zinc metal. ZincOx subsequently stated that it considered its zinc recovery plans for Big River Zinc to be uneconomic (ZincOx Resources plc, 2008, p. 12; Rudarakanchana, 2015).

Consumption

Changes in zinc consumption generally follow trends in industrial production or, more generally, economic growth. Domestic apparent consumption of zinc in 2015 was 931,000 t, a 4% decrease from apparent consumption in 2014 (table 1).

According to reported data, most of the zinc consumed domestically in 2015 was for the production of galvanized (zinc-coated) steel (table 5). Galvanized steel is used extensively in the automotive and construction industries. Most of the zinc consumed domestically for galvanizing was at continuous galvanizing plants. There were an estimated 46 continuous galvanizing plants operated by 18 companies in the United States, and leading producers of galvanized sheet included AK Steel Corp. (West Chester, OH), ArcelorMittal USA LLC (East Chicago, IN), Nucor Corp. (Charlotte, NC), Steel Dynamics (Fort Wayne, IN), and U.S. Steel (Pittsburgh, PA). The balance of zinc consumed for galvanizing was at general galvanizing plants that treat fabricated steel shapes (for example, structural beams or fasteners). There were about 180 general galvanizing plants operated by 80 companies in the United States in 2015, of which the leading included AZZ Inc. (Fort Worth, TX), Valmont Industries Inc. (Omaha, NE), and Voigt & Schweitzer LLC (Columbus, OH).

In June, AZZ announced that it had acquired U.S. Galvanizing LLC (Hurst, TX), a subsidiary of Trinity Industries Inc. (Dallas, TX). As part of the acquisition, AZZ acquired six additional galvanizing plants in Louisiana, Mississippi, and Texas, increasing the company's total number of galvanizing plants to 42. AZZ also secured a long-term service agreement

with Trinity Meyer Utility Structures LLC (Memphis, TN), a manufacturer of steel transmission towers and substation structures, through the purchase (AZZ Inc., 2015).

Other major end uses of zinc included brass and bronze, chemicals, semimanufactures, and zinc-base alloys. According to the Copper Development Association Inc. (2016), about 162,000 t of zinc (including unalloyed and in secondary copper alloys) was consumed for the production of brass (copper-zinc alloy) and bronze (copper-tin alloy with a small amount of zinc) in 2015, unchanged from that of 2014. Leading zinc chemicals, by production volume, were zinc oxide, which is used extensively in the tire manufacturing industry as an activator in the vulcanization process, and zinc sulfate, which is used as a micronutrient additive in animal feed and fertilizers. Leading zinc oxide producers included U.S. Zinc and Zinc Oxide LLC (Dickson, TN). U.S. Zinc consumed zinc dross and skimmings to produce up to 78,000 t/yr of zinc oxide at its two plants in Clarksville, TN, and Millington, TN (U.S. Zinc Corp., 2016). Zinc Oxide consumed zinc metal and secondary zinc materials at its 40,000-t/yr zinc oxide plant in Dickson, TN (Zinc Oxide LLC, undated). Zinc semimanufactures included mainly zinc sheet, also known as rolled zinc, which is used in architectural applications and for the production of the U.S. 1-cent coin. Zinc-base alloys were mainly produced by about 15 companies and predominantly used to make die-cast parts for applications such as automotive parts, builders and household hardware, electronics, home appliances, medical instruments, office equipment, power tools, and zippers.

Stocks

Reported producer and consumer stocks of zinc in the United States increased by 4% to 91,300 t in 2015 (table 1). Global London Metal Exchange Ltd. (LME) warehouses held 462,700 t of zinc at yearend 2015, a 33% decrease (228,125 t) from the yearend 2014 stock level, and the Shanghai Futures Exchange held 200,000 t of zinc, a 141% increase (117,000 t) from that of 2014. In the United States, LME stocks of zinc were mostly held in warehouses in New Orleans, LA, with a smaller amount held in Detroit, MI. At yearend 2015, LME warehouses in New Orleans, LA, held 365,725 t of zinc, or 79% of global stocks, a 41% decrease from the 616,500 t held at yearend 2014. Monthend stocks of zinc in New Orleans warehouses mostly decreased during the year, with the exception of August and September when monthend stocks increased by more than 75,000 t. In Detroit, MI, stocks of zinc were almost depleted by yearend 2015, decreasing to 25 t from 28,825 t at yearend 2014 (International Lead and Zinc Study Group, 2016c, p. 55).

Aside from the United States, China was the only other country known to hold a Government stockpile of zinc. China's State Reserve Bureau manages its stockpile, which contained 254,000 t of zinc at yearend 2015, unchanged from the stock level at yearend 2014 (International Lead and Zinc Study Group, 2016c, p. 55).

Prices

As reported by Platts Metals Week, the annual average LME cash price for SHG zinc in 2015 decreased by 11% from that

of 2014 to \$1,932.14 per metric ton (87.64 cents per pound) (table 1). Prices decreased in the first quarter, averaging \$2,110.32 per metric ton (95.72 cents per pound) in January and falling to an average of \$2,028.60 per metric ton (92.02 cents per pound) in March. Monthly average prices increased for the next 2 months, reaching a high of \$2,289.13 per metric ton (103.83 cents per pound) in May, before decreasing by 34% to an average of \$1,521.74 per metric ton (69.02 cents per pound) in December. Decreasing metal prices during this time were attributed to weakening global economic conditions and slowing growth in China. The annual average North American price for SHG zinc in 2015, which was based on the LME cash price plus a regional North American premium, was 95.54 cents per pound, 11% less than that in 2014 (table 1). Monthly average North American SHG premiums generally decreased during the year, averaging about 8.7 cents per pound in January and decreasing to around 7.0 cents per pound in December. Decreasing premiums are generally indicative of an increasing supply of zinc in a regional market.

CME Group Inc. (Chicago, IL) began trading zinc futures contracts in June. Similar to LME futures contracts, CME's COMEX zinc futures contracts were priced in dollars per metric ton and were for SHG zinc ingots in lots of 25 t for physical delivery. Three warehousing companies, C. Steinweg, Inc., Dearborn Distribution Services, and Henry Bath LLC, were certified as exchange-approved storage facilities in Baltimore, MD; Chicago, IL; Detroit, MI; and New Orleans, LA. CME Group stated that the zinc futures contracts would increase transparency and price discovery for zinc market participants in North America (CME Group Inc., 2015).

World Review

Mine Production.—Global zinc mine production in 2015 decreased for the first time since 2009, falling by 4% from that of 2014, mostly as a result of a 630,000-t decrease in production in China. China (34% share of global production), Australia (13%), and Peru (11%) continued to be the three leading producers of zinc in concentrate in 2015. The United States was the fourth leading producer, accounting for 6% of global zinc mine production. Outside of China, zinc mine production also decreased significantly in Canada (75,600 t), Namibia (49,100 t), and Ireland (46,300 t). Partially offsetting these decreases were production increases in India (115,000 t) and Peru (103,000 t) (table 9).

Three zinc mines closed permanently in 2015 owing to a depletion of reserves, including MMG Ltd.'s (Australia) Century Mine in Australia, which had the capacity to produce 500,000 t/yr of zinc in concentrate at full production; Vedanta Resources plc's (United Kingdom) Lisheen Mine in Ireland (175,000 t/yr of zinc in concentrate capacity); and Teck's Duck Pond Mine in Canada (34,000 t/yr of zinc in concentrate capacity). Additionally, several companies announced mine suspensions and production cutbacks in response to the price decline in the latter half of the year. In October, Glencore plc (Switzerland) announced that it planned to reduce its zinc mine production rate by 500,000 t/yr of zinc in concentrate, equivalent to about one-third of its production. Operations at its Lady Loretta Mine in Australia and the Iscaycruz Mine in

Peru were to be suspended, and production was to be reduced at the George Fisher and McArthur River Mines in Australia and at its Kazzinc Mines in Kazakhstan (Glencore plc, 2015). In November, Nyrstar NV announced that it was considering several courses of action in relation to its zinc mining business, including cutting its zinc concentrate output by an additional 400,000 t/yr, selling certain zinc mines, or exiting the mining business altogether. Earlier in the year, Nyrstar suspended production at the Myra Falls polymetallic mine in Canada and at the Campo Morado zinc-copper mine in Mexico, resulting in a 100,000-t/yr reduction in the company's zinc concentrate output. Production operations at Campo Morado were suspended in early January owing to security issues in the area, and Nyrstar transitioned the mine to care-and-maintenance status in the fourth quarter (Nyrstar NV, 2015b, 2016a). Trecora Resources (Sugar Land, TX) temporarily suspended operations at the Al Masane copper-zinc mine in Saudi Arabia in late November. The company planned improvements at the site during the closure to reduce costs once it reopened (Trecora Resources, 2015). Partially offsetting these closures were several additions totaling 105,000 t/yr of zinc mine capacity (International Lead and Zinc Study Group, 2016b, p. 35–36).

Metal Production.—Global zinc metal production increased slightly in 2015 from that of the prior year to 13.9 Mt. China (44% share of global production), the Republic of Korea (7%), India (6%), Canada (5%), and Japan (4%) were the leading producers of refined zinc metal in 2015. Production increased most significantly in China (293,000 t) and India (122,000 t); partially offsetting these increases was a notable production decrease in Namibia (47,000 t) (table 10). Global zinc smelter capacity decreased by 90,000 t/yr in 2015 as a result of Sumitomo Metal Mining Co., Ltd. (Japan) discontinuing the production of zinc at its Harima smelter in Japan in order to expand its production of nickel sulfate at the facility. There were no zinc smelter openings in the year (Sumitomo Metal Mining Co., Ltd., 2014; International Lead and Zinc Study Group, 2016b, p. 40–41).

Metal Consumption.—According to ILZSG, global zinc metal consumption was flat in 2015 at 13.7 Mt. Notable increases in China, the Czech Republic, France, Peru, South Africa, Thailand, and Vietnam offset reported decreases in Australia, Brazil, India, Italy, Japan, and the United States. The leading consumer of zinc was China, accounting for 47% of global consumption. Other significant consumers included, in decreasing order of consumption, the United States, India, the Republic of Korea, Japan, Germany, and Belgium; collectively, these countries accounted for 25% of global consumption. ILZSG's data indicated that, after being in a deficit for 2 years, the zinc metal market switched to being in surplus, with production exceeding consumption by 152,000 t in 2015 (International Lead and Zinc Study Group, 2016c, p. 46–47, 52).

Australia.—In August, MMG Ltd. completed mining activities at the Century Mine and continued to process about 700,000 t of stockpiled ore during the final months of 2015. Century operated for 16 years, and at full production, was one of the leading global zinc-producing mines. In 2015, the mine produced 393,000 t of zinc in concentrate, 16% less than that in 2014 (MMG Ltd., 2015; 2016, p. 26).

Canada.—Zinc mine production in Canada was 277,000 t in 2015, 21% less than that in 2014 (table 9). Production decreased in 2015 owing mostly to the closure of Yukon Zinc Corp.'s Wolverine Mine, lower zinc in concentrate output at Glencore's Matagami mill, and the temporary suspension of operations at Nyrstar's Myra Falls Mine. In January, Yukon Zinc announced that it planned to put the Wolverine Mine on care-and-maintenance status as a result of low zinc prices and high operating costs. Wolverine had been operating at 75% of capacity since 2013, producing 84,000 t of zinc concentrate (gross weight) in 2014 (Metal Bulletin, 2015b; Yukon Zinc Corp., 2015). In May, Nyrstar suspended operations at Myra Falls in order to improve mine conditions, and the company initially planned to restart the mine in the latter half of 2016. Later in the year, however, Nyrstar decided to defer development work at Myra Falls for at least an additional year owing to the zinc price decline in the second half of 2015. Myra Falls produced 9,000 t of zinc in 2015 compared with 26,700 t in 2014 (Nyrstar NV, 2015a; 2016a, p. 12, 23).

China.—Zinc mine production in China decreased by 13% in 2015 from that of 2014 to 4.3 Mt (table 9) and took place predominantly in the Inner Mongolia Autonomous Region and Hunan and Yunnan Provinces, where combined production accounted for more than one-half of China's zinc in concentrate production in 2015. According to Beijing Antaika Information Development Co., Ltd. (Antaika), stricter environmental regulations caused many small mines to close during the year, whereas other mines stopped production as a result of high smelter treatment charges and low zinc prices in the second half of the year. As a result of the decrease in mine production, China's net imports of zinc in concentrate increased considerably (by 37%) in 2015 to about 1.5 Mt. About 70% of China's zinc concentrate imports (gross weight) were sourced from Australia and Peru (Beijing Antaika Information Development Co., Ltd., 2016a, p. 13–14, 2016b; Global Trade Information Services Inc., 2016).

Zinc metal production rose by 5% in 2015 from that of 2014 to 6.1 Mt (table 10). Zinc smelters in China were reported to have operated at higher production rates in 2015 than in 2014 owing to an increase in domestic smelter treatment charges during the year. Hunan, Shaanxi, and Yunnan were the three leading zinc-metal-producing Provinces in China and accounted for about one-half of the country's zinc metal production in 2015. Domestic smelter production capacity in China increased by at least 200,000 t/yr in 2015; Anhui Tongguan Non-Ferrous Metal Chizhou Co. Ltd. and Western Mining Co. Ltd. each added 100,000 t/yr of zinc metal production capacity at their smelters in Chizhou, Anhui Province, and Xining, Qinghai Province, respectively (Beijing Antaika Information Development Co. Ltd., 2016a, p. 15–16).

China's zinc consumption increased at a slower rate in 2015 from that of 2014, coinciding with a decreasing growth rate in the country's automotive, construction, and industrial sectors. ILZSG reported a slight year-on-year increase in zinc consumption in 2015 compared with an 8% increase in 2014 (CRU International Ltd., 2016, p. 40–42; International Lead and Zinc Study Group, 2016c, p. 47).

India.—After decreasing in 2014, zinc mine and metal production increased significantly in India in 2015 owing to increased production at Hindustan Zinc Ltd.'s (HZL's) [a joint venture predominantly between Vedanta (64.92%) and the Government of India (29.54%)] Rampura Agucha zinc-lead mine and Sindesar Khurd silver-zinc-lead mine. From April through September 2014, HZL mined more waste rock than ore as it began transitioning Rampura Agucha from an open pit to an underground operation, resulting in a decrease in the company's mine and metal production. In the fourth quarter of 2014, Rampura Agucha's total lead and zinc mine production recovered after excavation work concluded, and in 2015 total mined metal production was 18% more than that in 2014. As an open pit mine, Rampura Agucha's ore production capacity was 6.15 million metric tons per year (Mt/yr). HZL planned to operate both the open pit and underground mine until the fiscal year ending March 31, 2020, maintaining an average production rate of about 5.0 Mt/yr of ore. Once Rampura Agucha becomes solely an underground mine, ore production capacity would decrease to 3.75 Mt/yr. HZL increased ore production capacity at Sindesar Khurd to 3.0 Mt/yr in the fiscal year ending March 31, 2016, from 1.9 Mt/yr in the previous fiscal year and planned to further increase capacity to 3.75 Mt/yr by the fiscal year ending March 31, 2020. As a result of increased production at the two mines, the company's total zinc metal output from its three smelting operations in India also increased (Hindustan Zinc Ltd., 2015, p. 14, 28; 2016, p. 28, 31–32).

Ireland.—Zinc mine production in Ireland decreased by 16% in 2015 from that of 2014 to 236,000 t of contained zinc (table 9) mostly as a result of the closure of Vedanta's Lisheen Mine. Mining activities at Lisheen concluded in November, and concentrate production stopped in December. Lisheen began operating in 1999 and typically produced about 300,000 t/yr of zinc concentrate (gross weight) (Vedanta Resources plc, 2016b).

Namibia.—Zinc mine and metal production decreased notably in Namibia in 2015 owing mostly to a decline in production at Vedanta's Skorpion complex in the southern Namib Desert. Mined zinc oxide ore at Skorpion was treated onsite at an SX-EW refinery with the capacity to produce 150,000 t/yr of SHG zinc. Vedanta reported that zinc metal production at Skorpion was 82,000 t in the fiscal year ending March 31, 2016, 20% less than production in the previous fiscal year as a result of lower ore grades at the mine, planned maintenance at the refinery, and a slower than anticipated rampup after maintenance work was completed. The company anticipated that the mine would close in the fiscal year ending March 31, 2017, and considered increasing the depth of the deposit to potentially extend the mine life to the fiscal year ending March 31, 2019. In November 2014, Vedanta announced that it had approved investment for the Gamsberg-Skorpion Integrated Zinc Project. The project included developing the Gamsberg zinc deposit in South Africa into an open pit mine and reconfiguring the Skorpion refinery to allow it to treat zinc sulfide concentrates, including those generated by Gamsberg. At the end of the fiscal year ending March 31, 2016, Vedanta was in the process of finalizing a feasibility study for the refinery conversion (Vedanta Resources plc, 2015, p. 15–17; 2016a, p. 55, 66–67).

Peru.—Zinc mine production in Peru increased by 8% in 2015 from that of 2014 (table 9) mostly as a result of increased production at the Antamina copper-zinc mine [a joint venture among BHP Billiton plc (33.75%), Glencore plc (33.75%), Teck (22.5%), and Mitsubishi Corp. (10%)] and at Sociedad Minera El Brocal S.A.A.'s (El Brocal's) Colquijirca zinc-lead-silver mine (Ministry of Energy and Mines of Peru, 2016, p. 59). Zinc production increased by 11% at Antamina in 2015 to 235,000 t owing to increased mill throughput and share of copper-zinc ore processed as opposed to copper ore. From 2017 through 2019, zinc production at Antamina was projected to increase significantly as mining was expected to take place in an area of higher zinc grades resulting in an increased proportion of copper-zinc ore mined. Copper and zinc production at Antamina can vary significantly from year to year owing to the geology of the deposit (Teck Resources Ltd., 2016a, p. 21–22). The Colquijirca Mine reached its full processing capacity of 18,000 t/d in December, resulting in zinc production increasing to 53,300 t in 2015 from 10,100 t in 2014. El Brocal completed a mill capacity expansion project at Colquijirca in 2014 that included building a second processing plant with a capacity of 11,000 t/d for the treatment of lead-zinc ore and increasing the capacity of the original concentrator, allocated for the treatment of copper ore from the adjacent Marcapunta Mine, to 7,000 t/d from 5,000 t/d (Buenaventura Mining Co. Inc., 2013, p. F–15; 2016, p. 56–57).

South Africa.—In November 2014, Vedanta approved capital expenditure for the Gamsberg-Skorpion Integrated Zinc Project, which included the development of the Gamsberg zinc deposit. According to the company, Gamsberg was one of the largest undeveloped zinc-bearing ore bodies globally and, once developed, would partially replace the zinc production lost from the closure of the company's Lisheen zinc mine in Ireland. Located in the Northern Cape Province near Vedanta's Black Mountain zinc mine, the deposit would be developed into an open pit mine that was expected to produce 250,000 t/yr of zinc in concentrate during a 13-year mine life with potential for further expansion. In July, Vedanta began development work at Gamsberg. Mill construction and prestripping activities were expected to take 2 years to complete, and production was projected to begin in 2018 with the mine reaching full capacity in 9 to 12 months (Vedanta Resources plc, 2015, p. 18; 2016a, p. 6, 67).

Outlook

ILZSG forecast global zinc consumption in 2016 to be essentially unchanged from that in 2015 as a slight increase in China's consumption would be offset by a decrease in the United States. In Europe, consumption was projected to remain flat. On the supply side, ILZSG forecast global zinc mine production to decrease by 6% as a result of production decreases in Australia, India, Ireland, and Peru. Metal production, which would be constrained by the decrease in mine production, is forecast to decline by 3% in 2015 owing to decreases in Argentina, Australia, Belgium, India, Mexico, and the United States. Overall, zinc metal consumption is expected to exceed production by 349,000 t in 2016, the largest deficit in recent decades (International Lead and Zinc Study Group, 2016a).

References Cited

- AZZ Inc., 2015, AZZ Incorporated announces agreement to acquire the galvanizing business of Trinity Industries: Fort Worth, TX, AZZ Inc. press release, June 5, 3 p. (Accessed May 11, 2017, at <http://www.azz.com/sites/default/files/AZZ%20-%20US%20Galvanizing%20Acquisition%20from%20Trinity%20Inds.%20-%200060515.pdf>.)
- Beijing Antaika Information Development Co., Ltd., 2016a, Lead and zinc monthly: Beijing Antaika Information Development Co., Ltd., no. 228, January, 28 p.
- Beijing Antaika Information Development Co., Ltd., 2016b, Lead and zinc monthly: Beijing Antaika Information Development Co., Ltd., no. 229, February, 8 p.
- Buenaventura Mining Co. Inc., 2013, Form 20–F—2012: U.S. Securities and Exchange Commission, April 30, [variously paged]. (Accessed May 2, 2016, at https://www.sec.gov/Archives/edgar/data/1013131/000114420413025112/v343000_20f.htm.)
- Buenaventura Mining Co. Inc., 2016, Form 20–F—2015: U.S. Securities and Exchange Commission, May 2, [variously paged]. (Accessed May 2, 2016, at https://www.sec.gov/Archives/edgar/data/1013131/000114420416098224/v437647_20f.htm.)
- Copper Development Association Inc., 2016, Annual data 2016—Copper supply & consumption—1995–2015: New York, NY, Copper Development Association Inc., 20 p. (Accessed November 7, 2016, at http://www.copper.org/resources/market_data/pdfs/annual_data.pdf.)
- CME Group Inc., 2015, CME Group announces the launch of physically delivered zinc futures: Chicago, IL, CME Group Inc. press release, May 18. (Accessed May 18, 2015, at <http://investor.cmegroup.com/investor-relations/releasedetail.cfm?ReleaseID=913620>.)
- CRU International Ltd., 2016, Zinc market outlook: London, United Kingdom, CRU International Ltd., January, 110 p.
- Defense Logistics Agency Strategic Materials, 2015, Annual materials plan for FY 2016: Fort Belvoir, VA, Defense Logistics Agency Strategic Materials news release, October 1, 1 p. (Accessed October 1, 2015, at <http://www.dla.mil/Portals/104/Documents/StrategicMaterials/Announcements/3101%20FY16%20AMP.pdf>.)
- Fitzgerald, Michael, and Tran, Estelle, 2015, US steelmakers file antidumping petition against corrosion-resistant sheet steel imports: Platts Metals Daily, v. 4, no. 107, June 3, p. 1, 6.
- Glencore plc, 2015, Glencore to reduce mine production by 500,000 tonnes of zinc metal per annum: Baar, Switzerland, Glencore plc news release, October 9, 2 p. (Accessed October 9, 2015, at <http://www.glencore.com/assets/media/doc/news/2015/201510090100-Glencore-to-reduce-mine-production-by-500000-tonnes-of-zinc-metal-per-annum.pdf>.)
- Global Trade Information Services Inc., 2016, Global trade atlas: Global Trade Information Services Inc. (Accessed October 25, 2016, via <https://www.gtis.com/gta>.)
- Hecla Mining Co., 2016, Form 10–K—2015: U.S. Securities and Exchange Commission, [variously paged]. (Accessed February 23, 2016, at https://www.sec.gov/Archives/edgar/data/719413/000143774916025805/h120151231_10k.htm.)
- Hindustan Zinc Ltd., 2015, Annual report 14–15: Udaipur, India, Hindustan Zinc Ltd., 145 p. (Accessed May 20, 2015, at http://www.hzindia.com/common/pdf/Hindustan-Zinc-AR-2014-2015_Navigational.pdf.)
- Hindustan Zinc Ltd., 2016, Annual report 2015–16: Udaipur, India, Hindustan Zinc Ltd., 160 p. (Accessed June 6, 2016, at http://www.hzindia.com/common/images/HZ_Final_Annual_Report-15-16.pdf.)
- Horsehead Holding Corp., 2015, Form 10–Q—For the quarterly period ended September 30, 2015: U.S. Securities and Exchange Commission, [variously paged]. (Accessed May 11, 2017, at <https://www.sec.gov/Archives/edgar/data/1385544/000138554415000016/zinc-20150930x10q.htm>.)
- International Lead and Zinc Study Group, 2016a, ILZSG session/forecasts: Lisbon, Portugal, International Lead and Zinc Study Group press release, October 31, 5 p. (Accessed November 8, 2016, via <http://www.ilzsg.org/>.)
- International Lead and Zinc Study Group, 2016b, Lead and zinc new mine and smelter projects: Lisbon, Portugal, International Lead and Zinc Study Group, 67 p.
- International Lead and Zinc Study Group, 2016c, Lead and zinc statistics—Monthly bulletin of the International Lead and Zinc Study Group: Lisbon, Portugal, International Lead and Zinc Study Group, August, v. 56, no. 8, 77 p. (Accessed October 25, 2016, via <http://www.ilzsg.org/>.)

- Lavigne, Grace, 2015, Star Mountain aims to restart Balmat zinc mine: American Metal Market, October 16. (Accessed October 16, 2015, via <http://www.amm.com/>.)
- Metal Bulletin, 2015a, USA seeks dispute panel over alleged Chinese subsidies: Metal Bulletin, April 14. (Accessed on April 14, 2015, via <http://www.metalbulletin.com/>.)
- Metal Bulletin, 2015b, Yukon Zinc idling Wolverine Mine, axes workers: Metal Bulletin, no. 9392.1, February 2, p. 3–4.
- Ministry of Energy and Mines of Peru, 2016, Annual mining report 2015: Lima, Peru, Ministry of Energy and Mines of Peru, 159 p. (Accessed November 8, 2016, via http://www.minem.gob.pe/_publicacion.php?idSector=1&idPublicacion=524.)
- MMG Ltd., 2015, Mining completed at MMG Century Mine: Melbourne, Victoria, Australia, MMG Ltd. news release, October 1. (Accessed October 1, 2015, at <http://www.mmg.com/en/Investors-and-Media/News/2015/10/01/Mining-completed-at-MMG-Century-mine.aspx?pn=1&bkckitem=BA5603A202CE4D1E848FABA9D1339247>.)
- MMG Ltd., 2016, Annual report 2015: Melbourne, Victoria, Australia, MMG Ltd., 136 p. (Accessed October 28, 2016, at http://www.mmg.com/en/Investors-and-Media/Reports-and-Presentations/~/_media/MMG%20AR15_Web.pdf.)
- Nyrstar NV, 2015a, 2015 second interim management statement and CEO update: Balen, Belgium, Nyrstar NV news release, October 22, 15 p. (Accessed October 22, 2015, at http://www.nyrstar.com/investors/en/Nyr_Documents/Q3-2015%20Results_ENG.pdf.)
- Nyrstar NV, 2015b, Nyrstar announces key measures to enhance balance sheet strength: Balen, Belgium, Nyrstar NV news release, November 9. (Accessed November 9, 2015, at <http://www.nyrstar.com/investors/en/news/Pages/1965259.aspx>.)
- Nyrstar NV, 2016a, 2015 full year results: Balen, Belgium, Nyrstar NV news release, February 4, 24 p. (Accessed February 24, 2016, at http://www.nyrstar.com/investors/en/Nyr_Documents/Nyrstar_2015_Release_EN.pdf.)
- Nyrstar NV, 2016b, Nyrstar 2015 mineral resource and mineral reserve statement: Balen, Belgium, Nyrstar NV news release, April 27, 14 p. (Accessed April 27, 2016, at http://www.nyrstar.com/investors/en/Nyr_Documents/2015%20Mineral%20Resource%20and%20Reserve%20Statement.pdf.)
- Office of the U.S. Trade Representative, 2015, United States launches challenge to extensive Chinese export subsidy program: Washington, DC, Office of the U.S. Trade Representative news release, February 11. (Accessed February 11, 2015, at <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2015/february/united-states-launches-challenge>.)
- Rudarakanchana, Nat, 2015, Former Big River Zinc site slated for redevelopment: American Metal Market, October 6. (Accessed October 6, 2015, via <http://www.amm.com/>.)
- Star Mountain Resources, Inc., 2015, Star Mountain Resources, Inc. to acquire Balmat Zinc Mine in New York State: Tempe, AZ, Star Mountain Resources, Inc. new release, October 15. (Accessed October 15, 2015, at <http://www.marketwired.com/press-release/star-mountain-resources-inc-to-acquire-balmat-zinc-mine-in-new-york-state-otcbb-smrs-2064332.htm>.)
- Sumitomo Metal Mining Co., Ltd., 2014, End of production of zinc products at Harima smelter: Tokyo, Japan, Sumitomo Metal Mining Co., Ltd. press release, October 20, 1 p. (Accessed May 11, 2017, at http://www.smm.co.jp/E/news/release/uploaded_files/141020-3e.pdf.)
- Teck Resources Ltd., 2014, Teck announces first shipment of concentrate from restarted Pend Oreille operations: Vancouver, British Columbia, Canada, Teck Resources Ltd. news release, December 17. (Accessed December 17, 2014, at <http://www.teck.com/news/news-releases/2014/teck-announces-first-shipment-of-concentrate-from-restarted-pend-oreille-operations>.)
- Teck Resources Ltd., 2016a, 2015 annual information form: Vancouver, British Columbia, Canada, Teck Resources Ltd., March 1, 104 p. (Accessed August 24, 2016, at http://www.teck.com/media/Investors-aif_march_2016_T5.1.2.pdf.)
- Teck Resources Ltd., 2016b, 2015 annual report: Vancouver, British Columbia, Canada, Teck Resources Ltd., 109 p. (Accessed August 24, 2016, at <http://www.teck.com/media/2015-Teck-Annual-Report.pdf>.)
- Trecora Resources, 2015, Trecora Resources announces temporary shutdown and improvement plan of AMAK plant in Saudi Arabia: Sugar Land, TX, Trecora Resources news release, November 27. (Accessed November 27, 2015, at <http://www.trecora.com/news/company-news/detail/1524/trecora-resources-announces-temporary-shutdown-and>.)
- U.S. Department of Commerce, International Trade Administration, 2015, Commerce preliminarily finds countervailable subsidization of imports of corrosion-resistant steel products from China, India, Italy, and Korea and no countervailable subsidization of imports from Taiwan: Washington, DC, U.S. Department of Commerce, International Trade Administration fact sheet, November 3, [7] p. (Accessed November 3, 2015, at <http://enforcement.trade.gov/download/factsheets/factsheet-multiple-corrosion-resistant-steel-cvd-prelim-110315.pdf>.)
- U.S. Zinc Corp., [2016], Zinc oxide: Houston, TX, U.S. Zinc Corp. (Accessed November 4, 2016, at <http://www.uszinc.com/products/zinc-oxide/>.)
- Vedanta Resources plc, 2015, Capital Markets Day, Hindustan Zinc Ltd., March 2015: London, United Kingdom, Vedanta Resources plc, March 20, presentation, 20 p. (Accessed September 14, 2016, at http://www.vedantaresources.com/media/173351/2.2015-03-20_ved_zinc_combined_investor_presentation_final.pdf.)
- Vedanta Resources plc, 2016a, Annual report FY2016: London, United Kingdom, Vedanta Resources plc, 240 p. (Accessed September 9, 2016, at http://www.vedantaresources.com/media/200956/vedanta_annual_report_fy2016_final.pdf.)
- Vedanta Resources plc, 2016b, Vedanta marks final shipment from Lisheen Mine in Ireland: PRNewswire news release, January 25. (Accessed January 25, 2016, at <http://www.prnewswire.com/news-releases/vedanta-marks-final-shipment-from-lisheen-mine-in-ireland-300208923.html>.)
- Yukon Zinc Corp., 2015, Yukon Zinc's Wolverine Mine on care & maintenance: Vancouver, British Columbia, Canada, Yukon Zinc Corp. news release, January 27, 1 p. (Accessed January 27, 2015, at http://www.yukonzinc.com/documents/150127_NewsRelease_%20Yukon_Zinc_Wolverine_Mine_on_Care_and_Maintenance.pdf.)
- Zinc Oxide LLC, [undated], Company profile: Dickson, TN, Zinc Oxide LLC. (Accessed November 4, 2016, at <http://www.zn-oxide.com/company-profile/>.)
- ZincOx Resources plc, 2008, Annual report & accounts 2007: Surrey, United Kingdom, ZincOx Resources plc, 60 p. (Accessed October 28, 2015, at <http://zincox.com/wp-content/uploads/2016/08/ZO2258-AR08-FD12.pdf>.)

GENERAL SOURCES OF INFORMATION

U.S. Geological Survey Publications

- Historical Statistics for Mineral and Material Commodities in the United States. Data Series 140.
- Zinc. Ch. in Mineral Commodity Summaries, annual.
- Zinc. Ch. in United States Mineral Resources, Professional Paper 820, 1973.
- Zinc. Mineral Industry Surveys, monthly.
- Zinc (Zn). Ch. in Metal Prices in the United States Through 2010, Scientific Investigations Report 2012–5188, 2013.

Other

- Defense Logistics Agency Strategic Materials.
- Economics of Zinc. Roskill Information Services, Ltd.
- International Lead and Zinc Study Group.
- Zinc. Ch. in Mineral Facts and Problems, U.S. Bureau of Mines Bulletin 675, 1985.

TABLE 1
SALIENT ZINC STATISTICS¹

(Metric tons, unless otherwise specified)

	2011	2012	2013	2014	2015	
United States:						
Production:						
Domestic ores, contained zinc	769,000	738,000	784,000	832,000	825,000	
Domestic ores, recoverable zinc	743,000	713,000	758,000	803,000	797,000	
Value, recoverable zinc	thousands	\$1,740,000	\$1,510,000	\$1,600,000	\$1,900,000	\$1,680,000
Refined zinc:						
At primary smelters	110,000	114,000	106,000	110,000	124,000	
At secondary smelters ^e	138,000	147,000	127,000	70,000	48,300	
Total	248,000	261,000	233,000	180,000	172,000	
Exports:						
Ores and concentrates, zinc content	653,000	591,000	669,000	644,000	709,000	
Refined zinc	18,400	14,200	11,500	19,800	12,700	
Imports for consumption:						
Ores and concentrates, zinc content	26,600	6,140	2,550	2	22	
Refined zinc	716,000	655,000	713,000	805,000	771,000	
Reported stocks of refined zinc, December 31:						
Producer and consumer	71,900	74,200	73,900	88,200 ^r	91,300	
Government stockpile	7,250	7,250	7,250	7,250	7,250	
Consumption, refined zinc:						
Reported	347,000	380,000	414,000	403,000	433,000	
Apparent ²	945,000	902,000	935,000	965,000	931,000	
Price: ³						
North American	cents per pound	106.24	95.76	95.57	107.12	95.54
London Metal Exchange, cash ⁴	do.	99.47	88.35	86.64	98.05	87.64
World production:						
Mine	thousands metric tons	12,500	12,900	13,100	13,300	12,800
Smelter	do.	13,100	12,600 ^r	13,000 ^r	13,500 ^r	13,900 ^e

^eEstimated. ^rRevised. do. Ditto.

¹Data are rounded to no more than three significant digits, except prices; may not add to totals shown.

²Smelter production plus imports for consumption minus domestic imports.

³Special High Grade. Source: Platts Metals Week.

⁴London Metal Exchange prices are published in dollars per metric ton and have been converted to cents per pound.

TABLE 2
MINE PRODUCTION OF RECOVERABLE ZINC
IN THE UNITED STATES, BY STATE¹

(Metric tons)

State	2014	2015
Alaska ²	660,000 ^r	629,000
Other ³	144,000	168,000
Total	803,000	797,000

^rRevised.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Data based, in part, on publicly available information.

³Includes production from Idaho, Missouri, Tennessee, and Washington.

TABLE 3
LEADING ZINC-PRODUCING MINES IN THE UNITED STATES IN 2015, IN ORDER OF OUTPUT¹

Rank	Mine	County and State ²	Operator	Source of zinc
1	Red Dog	Northern Region, AK	Teck Alaska Inc.	Zinc-lead ore.
2	East Tennessee Zinc Complex ³	Jefferson and Knox, TN	Nyrstar NV	Zinc ore.
3	Greens Creek	Southeastern Region, AK	Hecla Mining Co.	Zinc-silver ore.
4	Middle Tennessee Zinc Complex ⁴	Smith, TN	Nyrstar NV	Zinc ore.
5	Pend Oreille	Pend Oreille, WA	Teck American Inc.	Zinc-lead ore.
6	Brushy Creek	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
7	Lucky Friday	Shoshone, ID	Hecla Mining Co.	Silver ore.
8	Buick	Iron, MO	Doe Run Resources Corp.	Lead ore.
9	Viburnum (#29 and #35)	Washington and Iron, MO	do.	Do.
10	Sweetwater	Reynolds, MO	do.	Do.
11	Fletcher	do.	do.	Do.

Do., do. Ditto.

¹The mines on this list accounted for 100% of recoverable U.S. zinc mine production in 2015.

²For Alaska, mines are located by geographic region, as delineated by the Alaska Division of Geological & Geophysical Surveys in its Special Report 67, Alaska's mineral industry 2013—Exploration activity.

³Includes the Coy, Immel, and Young Mines.

⁴Includes the Cumberland, Elmwood, and Gordonsville Mines.

TABLE 4
ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF SCRAP¹

(Metric tons)

Type of scrap:	2014	2015
New scrap:		
Zinc-base	54,200	53,200
Copper-base	119,000	91,500
Magnesium-base	189	208
Total	173,000	145,000
Old scrap:		
Zinc-base	67,600	45,700
Copper-base	6,860	6,670
Aluminum-base	412	885
Magnesium-base	7	7
Total	74,800	53,300
Grand total	248,000	198,000

¹Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 5
U.S. REPORTED CONSUMPTION OF REFINED ZINC IN 2015, BY INDUSTRY USE AND GRADE¹

(Metric tons)

Industry use	Special High Grade	High Grade	Continuous Galvanizing Grade	Controlled Lead Grade	Prime Western	Remelt and other grades	Total
Galvanizing	69,800	68,200	210,000	--	18,700	260	367,000
Zinc-base alloys	27,300	82	--	--	--	--	27,400
Brass and bronze	24,300	9,970	--	--	98	--	34,300
Other	4,710	--	--	--	--	--	4,710
Total	126,000	78,200	210,000	--	18,800	260	433,000

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 6
U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY¹

	2014		2015	
	Quantity (metric tons, zinc content)	Value (thousands)	Quantity (metric tons, zinc content)	Value (thousands)
Australia	61,800	\$104,000	66,500	\$79,300
Belgium	51,700	87,100	52,900	67,100
Canada	222,000	321,000	225,000	311,000
China	1,540	278	1,350	737
Costa Rica	24	59	--	--
El Salvador	41	136	17	46
Finland	27,400	61,500	26,800	56,000
Germany	25,800	59,700	26,100	41,000
India	17	44	--	--
Italy	28,900	64,100	40,400	47,700
Japan	59,300	104,000	63,000	94,600
Korea, Republic of	87,200	150,000	120,000	144,000
Mexico	5	4	130	101
Norway	--	--	3,970	5,250
Panama	6	23	6	22
Spain	71,500	157,000	82,300	141,000
Switzerland	6,570	11,100	--	--
Venezuela	--	--	10	38
Total	644,000	1,120,000	709,000	987,000

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

Source: U.S. Census Bureau.

TABLE 7
U.S. EXPORTS OF ZINC COMPOUNDS¹

	2014		2015	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Chromates of zinc or of lead	12	\$490	24	\$713
Lithopone	623	4,580	1,040	7,200
Zinc chloride	681	1,000	419	657
Zinc oxide	6,170 ^r	20,800	21,800	28,900
Zinc sulfate	628	612	726	751
Zinc sulfide	1,570	19,200	780	14,100

^rRevised.

¹Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF ZINC COMPOUNDS¹

	2014		2015	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Chromates of zinc or of lead	112	\$744	128	\$2,220
Lithopone	1,770	2,750	1,210	1,630
Zinc chloride	149	1,270	154	1,150
Zinc oxide	125,000	272,000	116,000	250,000
Zinc sulfate	83,600	60,800	89,000	68,100
Zinc sulfide	2,290	8,700	2,460	8,050

¹Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

TABLE 9
ZINC: WORLD MINE PRODUCTION, BY COUNTRY¹

(Metric tons, zinc content of concentrate and direct shipping ore)

Country	2011	2012	2013	2014	2015
Argentina	33,975	39,602	39,424	40,000 ^{r,e}	30,000 ^e
Armenia ²	8,100	8,400	8,300	7,600	5,900
Australia	1,515,000	1,541,000	1,523,000	1,561,000	1,600,255
Bolivia	427,129	389,911	407,332	448,653	440,000 ^e
Bosnia and Herzegovina ^e	6,900	7,000	7,000	7,000	7,000
Brazil	197,840	164,258	152,147	169,766 ^r	160,000 ^e
Bulgaria	8,604	8,995	11,992	11,300 ^r	10,800
Burkina Faso	--	--	32,215	65,000	62,000 ²
Burma	9,300	10,000 ^e	10,000 ^e	10,000 ^e	10,000 ^e
Canada	622,600	641,134	426,545 ^r	352,125 ^r	276,519
Chile	36,602	26,762	29,759	45,094	48,071
China	4,050,000	4,380,000	4,730,000	4,930,000	4,300,000
Congo (Kinshasa)	14,944	11,571	12,806	14,584	12,675
Finland	64,115	52,303	40,956	35,000 ^{r,e}	27,000 ^e
Greece	19,564	20,912	21,000 ^{r,2}	21,000 ^{r,2}	12,000 ²
Guatemala	--	--	1,221	13,394	14,810
Honduras	25,945 ^r	25,603 ^r	25,223 ^r	29,509 ^r	22,992
India	796,000	758,000	793,000	706,000	821,000
Iran ^e	140,000	140,000	130,000	140,000	140,000
Ireland	344,000	337,500	326,700	282,600 ^r	236,300
Kazakhstan	376,700	369,700	361,500	345,200	339,300
Korea, North ^e	34,000	35,000	36,000	32,000	26,000
Korea, Republic of ²	740	1,430	1,750	1,920 ^r	2,070
Kosovo	3,000 ^e	3,818	4,983	5,166 ^r	3,986
Laos	1,600 ²	1,600 ²	1,500 ²	--	--
Macedonia ²	28,000	29,000	29,000	32,000 ^r	29,000
Mexico	631,859	660,349	642,542	659,878	680,000 ^e
Mongolia ²	52,400	59,600	52,100	46,600	44,800
Montenegro ^e	5,000	5,000	5,000	10,000	10,000
Morocco	45,050 ²	45,800 ²	41,100 ^{r,2}	44,800 ^{r,2}	45,000 ^e
Namibia	192,173 ²	194,380 ²	184,109 ²	172,783 ^r	123,672
Nigeria	3,100 ^r	13,800 ^r	7,000 ^r	8,200 ^{r,e}	8,800 ^e
Pakistan	15,000	10,000 ^e	5,000 ^e	--	--
Peru	1,256,383	1,281,230	1,351,273	1,318,660	1,421,523
Philippines	18,170	19,559	16,730	--	--
Poland	65,200	57,700	58,200	55,000 ^{r,e}	55,000 ^e
Portugal	4,227	30,006	53,382	67,378	61,921
Russia ³	176,300	179,800	177,200	175,000 ^e	210,000 ^e
Saudi Arabia	190 ^r	11,200 ^r	18,300 ^r	17,400 ^r	18,400
Serbia ^e	5,000	5,000	5,000	5,000	5,000
South Africa	36,629	37,034	30,145	26,141	29,040
Spain	33,199	28,634	30,428	26,756 ^r	41,765
Sweden	194,429	188,391	176,578	221,882	246,889
Tajikistan ^e	10,000	20,000	20,000	30,000	40,000
Thailand	29,664	31,000	30,000	39,140	34,738
Turkey	158,300 ⁴	200,000 ⁴	200,000 ⁴	211,000 ^r	175,000 ⁴
United States	769,000	738,000	784,000	832,000	825,000
Uzbekistan ^e	15,000	25,000	35,000	45,000	55,000
Vietnam	30,000 ^e	30,000 ^e	20,000 ^e	26,000 ^{r,2}	27,000 ²
Total	12,500,000	12,900,000	13,100,000	13,300,000	12,800,000

See footnotes at end of table.

TABLE 9
ZINC: WORLD MINE PRODUCTION, BY COUNTRY¹

(Metric tons, zinc content of concentrate and direct shipping ore)

⁶Estimated. ⁷Revised. -- Zero.

¹Totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown. Includes data available through May 22, 2017.

²Data derived from reported production of zinc concentrates.

³May not include production from some small-scale mining operations.

⁴Estimated based on reported exports of zinc ores and concentrates.

Sources: British Geological Survey; Bulgarian Association of the Metallurgical Industry; Chamber of Mines (Namibia); Chilean Copper Commission; China Nonferrous Metals Industry Association; Company reports; Department of Industry and Science (Australia); Department of Mineral Resources (South Africa); Department of Statistics of Kazakhstan; Geological Survey of Finland; International Lead and Zinc Study Group; Istanbul Study Group; Istanbul Minerals & Metals Exporters' Association; Korea Institute of Geoscience and Minerals Resources; Lao Department of Mines; Mineral Resources Authority of Mongolia; Mines and Geosciences Bureau (Philippines); Ministry of Energy and Mines (Peru); Ministry of Energy, Mines, Water and the Environment (Morocco); Ministry of Industry, Energy, and Tourism (Spain); Ministry of Mines (Democratic Republic of the Congo); Ministry of Congo; Ministry of Natural Resources and Ecology (Russia); National Department of Mineral Production (Brazil); National Institute of Statistics and Census (Argentina); National Institute of Statistics and Geography (Mexico); National Statistical Service of the Republic of Armenia; Natural Resources Canada; Polish Geological Institute; U.S. Geological Survey.

TABLE 10
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country	2011	2012	2013	2014	2015
Algeria, primary ^e	30,000	20,000	20,000	20,000	15,000
Argentina, primary	42,067	37,797	36,712	29,122	30,000 ^e
Australia, primary	507,316	498,259	498,291	481,573	489,594
Belgium, primary	282,000	250,000	252,000	262,000	260,000
Brazil, primary	284,770	246,526	245,417 ^r	246,120 ^{r,p}	230,000 ^e
Bulgaria, primary	90,083	73,558	75,830	76,300 ^r	75,100
Canada, primary	662,151	648,619 ^r	651,638 ^r	649,217	683,118
China, primary and secondary	5,212,200 ^r	4,881,200 ^r	5,279,600 ^r	5,807,000 ^r	6,100,000 ^e
Finland, primary	307,352	314,742	311,686	302,024	305,717
France, primary	164,000	161,000	152,000	171,000	169,000
Germany, primary and secondary	170,000	169,400 ^r	162,000	168,000 ^r	169,000
India, primary and secondary	789,938 ^r	711,266 ^r	769,506 ^r	699,993 ^r	821,617
Iran ^e	130,000	150,000	140,000	150,000	140,000
Italy, primary	100,000 ^e	100,000 ^e	111,000 ^r	138,100 ^r	139,200
Japan, primary and secondary	544,674	571,312	587,291	583,021	566,619
Kazakhstan, primary and secondary	319,847	319,900	320,150	324,946	324,340
Korea, North, primary and secondary ^e	35,000	35,000	35,000	30,000 ^r	20,000
Korea, Republic of, primary	828,735	876,550	885,804	900,943	934,949
Mexico, primary	322,116	323,569	322,781	320,924 ^r	326,642
Namibia, primary	145,639	144,508	128,000 ^r	119,000 ^r	72,000 ^e
Netherlands, primary	261,000	257,000	275,000	290,000	291,000
Norway, primary	153,200	152,647	143,444	165,600	162,878
Peru, primary	313,714	319,280	346,362	336,454	335,422
Poland, primary	144,100	138,300	146,300	140,000 ^e	140,000 ^e
Russia, primary and secondary	255,600	250,000	216,260	223,312	229,602
South Africa, primary	73,000	--	--	--	--
Spain, primary	489,104	489,455	490,488	491,331 ^r	491,000 ^e
Thailand, primary	103,366	97,000	78,000	70,100 ^{r,e}	74,121
United States:					
Primary	110,000	114,000	106,000	110,000	124,000
Secondary ^e	138,000	147,000	127,000	70,000	48,000
Total	248,000	261,000	233,000	180,000	172,000
Uzbekistan, primary	54,900	61,100	54,000	66,000	73,000
Vietnam, primary ^e	18,000	18,000	12,000	12,000	10,000
Grand total	13,100,000	12,600,000 ^r	13,000,000 ^r	13,500,000 ^r	13,900,000
Of which:					
Primary	5,490,000	5,340,000	5,340,000	5,400,000 ^r	5,430,000
Secondary ^e	138,000	147,000	127,000	70,000	48,000
Undifferentiated	7,460,000 ^r	7,090,000 ^r	7,510,000 ^r	7,990,000 ^r	8,370,000

^eEstimated. ^pPreliminary. ^rRevised. -- Zero.

¹Grand totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Wherever possible, detailed information on raw material source of output (primary—directly from ores, and secondary—from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undifferentiated (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output. Includes data available through May 22, 2017.

Sources: Bulgarian Association of the Metallurgical Industry; Chamber of Mines of Namibia; China Nonferrous Metals Industry Association; Company reports; Department of Statistics (Kazakhstan); Federal Institute for Geosciences and Natural Resources (Germany); Indian Bureau of Mines; International Lead and Zinc Study Group; Ministry of Economy, Trade, and Industry (Japan); Ministry of Energy and Mines (Namibia); Ministry of Energy and Mines (Peru); Ministry of Natural Resources and Ecology (Russia); National Department of Mineral Production (Brazil); National Institute of Statistics and Census (Argentina); Natural Resources Canada; Office of the Chief Economist (Australia); Polish Geological Institute; U.S. Geological Survey.